Operational Scenarios (cont.)

Contingency Operations

- LGS-to-LPS interface problems
  - prior to a contact
  - during data receipt
- LPS-to-LP DAAC interface problems
  - prior to data transfer
  - during data transfer operations
  - LPS output storage capacity
- Hardware failures
  - tape drive
  - data storage disks
- LPS string problems
  - data receipt/store
  - data processing
  - data transfer
  - file deletion

Landsat 7 Processing System SDR/SSR

Agenda

- Introduction
- System Design
- Software Specification
  - Approach
  - Software Requirement Specification
  - Software Sizing Estimates
- Conclusion

Landsat 7 Processing System SDR/SSR

Approach

- Requirement Traceability
- Software Reuse Identification
- Functional Decomposition
- Case Tools

Landsat 7 Processing System SDR/SSR

Requirements Traceability

- Mapped SDS allocated requirements to LPS F&PS baseline
- Mapped SRS requirements to SDS baseline

Mechanisms for Identifying Reuse

- Reuse Engineer
- Analyst Input within Detailed Functional Specifications

Initial Software Reuse Analysis

- Operational/Test/System Level Candidates
  - » Network Time Source (F-TS-01)
  - » Network Time Server (F-TS-02)
  - » Network Time Client (F-TS-03)
  - » History Logger (RT-HS-02)
    - Supports operator training/test functions
  - » History Replay (RT-HS-03)
    - Supports operator training/test functions

Initial Software Reuse Analysis (Cont.)

- Subsystem Level Candidates
  - » Discussed in detail during Software Requirements Specification

Prototype Integration

User Interface

Seven (7) Subsystems

- Management and Control Subsystem (MACS)
- Raw Data Capture Subsystem (RDCS)
- Raw Data Processing Subsystem (RDPS)
- Major Frame Processing Subsystem (MFPS)
- Image Data Processing Subsystem (IDPS)
- Payload Correction Data Processing Subsystem (PCDS)
- LPS Data Transfer Subsystem (LDTS)

Database

Cadre Teamwork

- Data Flow Diagrams
- Functional Specifications (P-Specs)
- Structure Charts
- Information Modeling (Database Design)
- Centralized Data Dictionary
- Requirement Tracking

CaseVision

- Compiler
- Debugger
- Performance Analyzer
- Configuration Management Tool (TBR)

Landsat 7 Processing System SDR/SSR

- Approach
- **Software Requirements Specification**
- Software Sizing Estimates

- Software Context Diagram
- Software Level 0
- User Interface
- Management and Control Subsystem (MACS)
- Raw Data Capture Subsystem (RDCS)
- Raw Data Processing Subsystem (RDPS)
- Major Frame Processing Subsystem (MFPS)
- Payload Correction Data Processing (PCDS)
- Image Data Processing Subsystem (IDPS)
- LPS Data Transfer Subsystem (LDTS)
- Database

Landsat 7 Processing System SDR/SSR

Software Context Diagram

File Name : lps_context
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:51:58 1995
Pages : 0

Landsat 7 Processing System SDR/SSR

Software Level 0

File Name : lps_0
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:51:58 1995
Pages : 0

Drivers

- Setup, test, monitor, and control the LPS system.
- Each LPS string is physically and logically independent. Each string must have its own user interface.
- Operations can be performed on several contacts at one time on the same string.

Constraints

- The budget for the user interface is very limited.

Assumptions

- No network interface will be available for input of schedules, parameters, etc. between LPS and external systems.
- No security will be provided other than what is available from the UNIX shell and from ORACLE.
- There will be only one type of user for the LPS system. This user type is classified as an "operator".
- The LPS operators will be capable of utilizing the operating system to perform some of the user interface functions..
- Prototype user interface screens will be developed and reviewed by LPS operators during design.
- No long term or trend reporting is required.

Input Processing Parameters and Configurations

- Input LPS setup tables
- Input thresholds for RDPS, MFPS, PCDS
- Input Image Processing Parameters
- Input contact schedules (from LGS)
- Input sensor alignment tables (from IAS)
  - » Investigating electronic transfer of scene id parameters

Provide System Monitoring

- Provide operational monitoring
- Report system faults
- Report process accounting information
- Examine LPS journal, BCH & CCSDS trouble files

Control Processing

- System startup/shutdown
- Start/Stop data capture
- Disable/Enable Level 0R file generation and data transfer to the LP DAAC
- Start/Stop tape copy
- Start/Stop reprocessing
- Delete/Retain files on a contact period basis

- ORACLE SQL*FORMS/SQL*MENU
- UNIX Shell commands
- COTS
  - » Distributed Process Control Program (DPCP)
  - » Distributed Application Monitor Tool (DAMT)

Landsat 7 Processing System SDR/SSR

Management and Control Subsystem (MACS)

File Name : lps_6
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:52:02 1995
Pages : 0

Process LPS Directive

- Provide capability to manually override LPS automated functions
- Provide capability to control LPS operation

Report LPS Status

- Provide monitoring to verify proper operation of system capabilities and components

Display/Print LPS Report

- Provide capability to display and or print LPS summary or accounting on operator request

Generate Metadata

- Generate Level 0R metadata files on a subinterval basis

Input

- IDPS
  - » ACCA Scores
  - » Status/error messages
  - » Quality and accounting information
- RDCS
  - » Data receive summary
  - » Status/error messages
  - » Quality and accounting information
- RDPS
  - » Return link QA report
  - » Status/error messages
  - » Quality and accounting information

Input (Cont.)

- MFPS
  - » Level 0R quality and accounting report
  - » Processing status information
  - » Quality and accounting information
  - » Subinterval information for metadata file creation
- PCDS
  - » Processing status information
  - » Quality and accounting information
  - » WRS table information
- LDTS
  - » LPS file transfer summary report
  - » Processing status information

Output

- RDCS
  - » Data receive schedule
  - » Setup parameters
  - » Directives
- RDPS
  - » Setup/processing parameters
  - » Directives
- MFPS
  - » Setup/processing parameters
  - » Directives
- Processing parameters to PCDS
- Browse band information to IDPS

Output

- LDTS
  - » Setup Parameters
  - » Directives
  - » Metadata files per subinterval
  - » Transfer file list per subinterval
- Operator
  - » LPS summary report
  - » LPS processing status

Landsat 7 Processing System SDR/SSR

MACS Performance Requirements

- Forward any directive to any subsystem within one second of its receipt from the operator
- Display a report within one second of its receipt from the subsystem providing the report
- Submit a report to a print queue within 1 second of its receipt from the subsystem providing the report
- Process received raw wideband metadata at a peak rate of not less than 230 bits per second (based on a peak raw wideband throughput of 7.5 Mbps)
- Provide the capability to execute concurrently with all other LPS subsystems.
- Begin to process metadata immediately upon receipt of required inputs

MACS Performance Requirements

- Output a metadata file within 250 seconds of the time of receiving all required inputs
- Output periodic status information it generates with a maximum latency of 30 seconds between outputs

- PACOR II method of Status reporting & monitoring
- (RT-HS-01) Event Logger
- (RT-US-06) Event Printer
- (OL-DP-02) Events Browser
- (RT-US-05) Reports
  - » possible for LPS Journal & trouble file examination
- (OL-DM-02) Data Reception
  - » Candidate if manual interfaces become automatic
- (OL-DP-03) Data Browser & Editor
  - » For trouble file examination

Landsat 7 Processing System SDR/SSR

MACS Software Reuse Candidates

- (OL-UI-01) Session Manager (system control)
- (OL-UI-02) Display Builder (X/Motif)
- (OL-DM-05) File Services
  - » Automate transfer of data to 60-day store or other backup functions
- Spacelab Data Processing Facility (SLDPF) Central Information System
  - » User Interface for status of pipeline processes
  - » Message logging

Landsat 7 Processing System SDR/SSR

Raw Data Capture Subsystem (RDCS)

File Name : lps_1
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:51:59 1995
Pages : 0

Receive Raw Wideband Data

– Receive return link wideband data per contact period

Save Raw Wideband Data

– Record return link wideband data to removable media

Generate Data Receive Summary

– Generate an LPS wideband data receive summary per contact period

Restage Raw Wideband Data

– Retrieve return link wideband data from removable media

Input

- Raw wideband data from LGS
- MACS
  - » LGS Channel ID
  - » LPS Hardware String ID
  - » Directive to begin data capture
  - » Directive to store data to removable media
  - » Directive to generate a data receive summary report
  - » Directive to retrieve data from removable media

Output

- Raw wideband data to removable media
- Raw wideband data sets to RDPS
- MACS
  - » Status/error messages
  - » Accounting information per contact period

Landsat 7 Processing System SDR/SSR

RDCS Performance Requirements

- Generate the information necessary to produce a data receive summary for received wideband data within 10 seconds of the conclusion of its capture
- Produce a data receive summary within 10 seconds of the receipt of the report directive from the MACS
- Receive the equivalent of any combination of the format 1 and 2 portions of the 125 Landsat 7 ETM+ scenes of wideband data per day
- Copy received wideband data to removable media at a minimum rate of 7.5 Mbps
- Copy received wideband data to removable media at a daily average aggregate rate of not less than 3 Mbps (TBR - Includes 10% overhead)

Landsat 7 Processing System SDR/SSR

RDCS Performance Requirements

- Copy received wideband data to removable media concurrently with Level 0R processing of that data
- Reprocess a maximum of 10% of a string's daily input volume of wideband data
- Maintain data processing throughput performance for all raw wideband data received with a BER of one bit error in 10^5 bits, without loss of Level 0R processed data and without retransmission
- Receive wideband data from a single LGS output channel at a maximum rate of 75 Mbps
- Receive wideband data for contact periods of up to 14 minutes
- Output any periodic processing status information that it generates with a maximum latency of 30 seconds between outputs

Landsat 7 Processing System SDR/SSR

RDCS Software Reuse Candidates

- LPS prototype for capturing raw data to disk
- System software for reading/writing to the removable media

Landsat 7 Processing System SDR/SSR

Raw Data Processing Subsystem (RDPS)

File Name : lps_2
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:51:59 1995
Pages : 0

Validate RDP Parameters

- Validate and store processing parameters received from the MACS

Synchronize CCSDS Frame

- Detect and synchronize on normal and inverted polarity wideband data concurrently
- Synchronize utilizing a Search/Check/Lock/Flywheel strategy
- Invert bits with inverted polarity
- Correct bit slips
- Perform Pseudo-Random Noise (PN) decoding

Process CCSDS Grade 3

- Perform CCSDS AOS Grade 3 service
- Storing all CADUs which fail the CCSDS AOS Grade 3 checks
- Delete VCDUs containing fill data

Decode BCH

- Perform BCH error detection and correction
- Store all CADUs which fail the BCH error detection and correction on the mission data zone

Check VCID

- Check and annotate changes in the VCID

Compute BER

- Compute the Bit Error Rate

Generate Return Link QA Report

- Generate a return link quality and accounting report per contact period

Input

- MACS
  - » CCSDS parameters
  - » Error thresholds
  - » Directive to process wideband data
  - » Directive to produce a return link quality and analysis report
- Raw wideband data sets from RDCS

Output

- MACS
  - » Status/error messages
  - » Return Link Quality and Analysis Report
- Provide annotated VCDUs to the MFPS

Landsat 7 Processing System SDR/SSR

RDPS Performance Requirements

- Process the equivalent of any combination of the format 1 and 2 portions of the 125 Landsat 7 ETM+ scenes of wideband data per day
- Receive wideband data at a minimum rate of not less than 7.5Mbps
- Execute concurrently with all other LPS subsystems
- Process received raw wideband data immediately upon receipt of required inputs
- Output one scene within 250 seconds of the time either at the beginning of processing or the time of its last output
- Reprocess a maximum of 10% of a string's daily input volume of wideband data

Landsat 7 Processing System SDR/SSR

RDPS Performance Requirements

- Process received wideband data at a daily average aggregate rate of 3 Mbps (Includes 10% reprocessing overhead)
- Maintain data processing throughput performance for all raw wideband data received with a BER of one bit error in 10^5 bits, without loss of Level 0R processed data and without retransmission
- Retrieve retained wideband data at rates equal to or greater than 7.5 Mbps
- Output any periodic processing status information that it generates with a maximum latency of 30 seconds between outputs

Landsat 7 Processing System SDR/SSR

RDPS Software Reuse Candidates

- Telemetry VCDU Statistics (RT-EX-06)
  - » CCSDS related Q&A data collection
- LPS CCSDS Frame Synchronization prototype
  - » Portions of SCLF process
  - » Byte alignment
  - » Data deinverting
  - » PN decoding
  - » CRC Check
- Landsat 7 Mission Data and Data Pointer BCH Decoder prototype

Landsat 7 Processing System SDR/SSR

Major Frame Processing Subsystem (MFPS)

File Name : lps_3
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:52:00 1995
Pages : 0

Validate Operator Controls

- Validate and store the processing parameters received from MACS

Identify VCDUs

- Identify and collect VCDUs on a major frame basis

Extract PCD

- Identify missing PCD bytes and provide information to PCDS

Parse Major Frame

- Locate the minor frames that contain synchronization, major frame time, end of line code, scene data, calibration data, and mirror scan correction data (MSCD)
- Determine the major frame time
- Determine the subinterval

Generate Band Data

- Deinterleave and align wideband data on a major frame basis

Extract Calibration and MSCD

- Extract, process, and generate calibration and MSCD files on a subinterval basis

Collect MFP Accounting

- Collect Level 0R quality and accounting information on a subinterval basis

Generate Reports

- Generate Level 0R quality and accounting reports on a subinterval basis

Input

- Receive annotated VCDUs from RDPS
- MACS
  - » Directive to produce a Level 0R quality and accounting report
  - » Setup parameters

Output

- PCDS
  - » PCD and related VCDU information
  - » Major frame time
  - » Subinterval ID, start time, and stop time

Output (Cont.)

- IDPS
  - » Status information from the VCDU
  - » Aligned bands
  - » Subinterval ID, start time, and stop time
- MACS
  - » Level 0R quality and accounting information for a subinterval
  - » Status/error messages
  - » Subinterval ID, start time, and stop time
- LDTS
  - » Calibration file
  - » Mirror Scan Correction Data (MSCD) file

Landsat 7 Processing System SDR/SSR

MFPS Performance Requirements

- Process the equivalent of any combination of the format 1 and 2 portions of the 125 Landsat 7 ETM+ scenes of wideband data per day
- Process received data at a minimum rate of not less than 7.5Mbps
- Execute concurrently with all other LPS subsystems
- Process received data immediately upon receipt of required inputs
- Output one scene worth of Major Frames and PCD within 240 seconds of the receipt of required inputs
- Reprocess a maximum of 10% of a string's daily input volume of wideband data

Landsat 7 Processing System SDR/SSR

MFPS Performance Requirements

- Process received wideband data at a daily average aggregate rate of 3 Mbps (Includes 10% reprocessing overhead)
- Maintain data processing throughput performance for all raw wideband data received with a BER of one bit error in 10^5 bits, without loss of Level 0R processed data and without retransmission
- Output any periodic processing status information that it generates with a maximum latency of 30 seconds between outputs

Landsat 7 Processing System SDR/SSR

MFPS Software Reuse Candidates

- Packet Extractor/Server (RT-EX-05)
  - » PCD/Status/Major Frame parsing that occurs after CCSDS processing
- TDM Processor (OL-DP-06)
  - » Major frame processing related Q&A information collection
- LPS Major Frame Processing prototype
  - » Scan bit search
  - » VCDU sequence count check

Landsat 7 Processing System SDR/SSR

Payload Correction Data Processing Subsystem (PCDS)

File Name : lps_4
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:52:01 1995
Pages : 0

Validate PCD Parameters

- Validate and store the processing parameters receives from MACS
- Provide status/alarms when specified thresholds are exceeded

Determine PCD Info Word

- Synchronize on PCD bytes

Assemble PCD Cycles

- Assemble PCD minor frames, using fill for missing PCD data.
- Assemble PCD major frames using the PCD minor frames
- Provide status/alarms when specified thresholds are exceeded

Calculate Scene Info

- Provide the capability to perform ETM+ scene identification within an accuracy of 1 kilometer in accordance with the WRS scheme
- Provide the capability to collect and store PCD quality and accounting and processed PCD quality and accounting data on a subinterval basis
- Provide the capability to identify the presence of calibration door activities

Extract Major Frame Info

- Calculate the spacecraft drift time based on information available in the PCD and append that time to the level 0R data file
- Provide the capability to collect and store PCD quality and accounting and processed PCD quality and accounting data on a subinterval basis

Create PCD File

- Provide the capability to generate PCD file(s) on a subinterval basis.
- Provide the capability to collect and store PCD quality and accounting and processed PCD quality and accounting data on a subinterval basis
- Provide the capability to generate the PCD level 0R file(s) on a received subinterval basis

Input

- MFPS
  - » Major frame time
  - » PCD words and information needed to process PCD data
  - » Beginning and ending major frame times corresponding to a predefined subinterval time range
- MACS
  - » Threshold values
  - » Parameters used to calculate WRS scene information
  - » Predefined value used to fill missing PCD data

Output

- IDPS
  - » Scene identification in accordance with the WRS scheme
  - » Equation that provides the difference between the spacecraft time and the actual time of the ETM+ major frame
- File containing PCD major frames received during a subinterval, on a full PCD cycle basis to the LDTS
- MACS
  - » Status/error messages
  - » Statistics gathered from the PCD processing

Landsat 7 Processing System SDR/SSR

PCDS Performance Requirements

- Process the equivalent of any combination of the format 1 and 2 portions of the 125 Landsat 7 ETM+ scenes of wideband data per day
- Process unpacked PCD data at a minimum rate of not less than 3.2 Kbps
- Execute concurrently with all other LPS subsystems
- Process received data immediately upon receipt of required inputs
- Output a scene center id, a sun azimuth at scene center value, and a sun elevation at scene center value within 240 seconds of the receipt of required inputs
- Reprocess a maximum of 10% of a string's daily input volume of wideband data

Landsat 7 Processing System SDR/SSR

PCDS Performance Requirements

- **Process unpacked PCD data at a daily average aggregate rate of 12.7 Kbps (Includes 10% reprocessing overhead)**
- **Maintain data processing throughput performance for all raw wideband data received with a BER of one bit error in 10^5 bits, without loss of Level 0R processed data and without retransmission**
- **Output any periodic processing status information that it generates with a maximum latency of 30 seconds between outputs**

Landsat 7 Processing System SDR/SSR

PCDS Software Reuse Candidates

- Generic Equation Processor (RT-TM-07)
  - » Scene center related latitude/longitude computations
- Real-Time Attitude Determination (RT-TM-08)
  - » WRS scene center identification related spacecraft attitude estimation
- Attitude Sensor Alignment and Calibration (OL-SD-01)
  - » Attitude estimation related to WRS scene center identification
- Non Real-Time Attitude Determination (OL-SD-02)
  - » Attitude estimation related to WRS scene center identification

- State Parameter Validation (OL-SD-04)
  - » Attitude and ephemeris estimation related to WRS scene center identification
- Attitude Measurement Processing (OL-SD-05)
  - » Attitude and ephemeris estimation related to WRS scene center identification
- Flight Dynamics Facility SWCI Library
  - » Greenwich Hour Angle Computation from the Julian Date
  - » GCI Sun Vector Computation

File Name : lps_5
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:52:01 1995
Pages : 0

Validate Band Parameter

- Validate and store the processing parameters received from the MACS

Generate Browse File

- Provide monochrome or multiband browse data for each ETM+ image on a subinterval basis

Generate Band File

- Generate band file for each band received on a subinterval basis

Perform ACCA

- Perform ACCA for WRS scenes on a scenes using predefined comparison values on a scene quadrant and full scene basis

Input

- MFPS
  - » Aligned bands
  - » Status information from the VCDU
  - » Subinterval ID, start time, and stop time
- PCDS
  - » Difference between spacecraft time and actual time
  - » Parameters used to calculate the scene identification
- Operator defined parameters from the MACS

Output

- LDTS
  - » Browse file
  - » Band files
- MACS
  - » Status/error messages
  - » ACCA scores by quadrant and one for the full scene
  - » Accounting information

Landsat 7 Processing System SDR/SSR

IDPS Performance Requirements

- Process the equivalent of any combination of the format 1 and 2 portions of the 125 Landsat 7 ETM+ scenes of wideband data per day
- Process aligned band data at a minimum rate of not less than 7.5 Mbps
- Execute concurrently with all other LPS subsystems
- Process received data immediately upon receipt of required inputs
- Output scene metadata within 250 seconds of the receipt of required inputs
- Reprocess a maximum of 10% of a string's daily input volume of wideband data

Landsat 7 Processing System SDR/SSR

IDPS Performance Requirements

- **Process received data at a daily average aggregate rate of 2.9 Mbps (Includes 10% reprocessing overhead)**
- **Maintain data processing throughput performance for all raw wideband data received with a BER of one bit error in 10^5 bits, without loss of Level 0R processed data and without retransmission**
- **Output any periodic processing status information that it generates with a maximum latency of 30 seconds between outputs**

- Landsat Browse Generation Using Wavelets for Image Reduction
  - » Reduce image by subsamples
  - » Reduce image by wavelets
- Cloud Cover Assessment (CCA) algorithm

Landsat 7 Processing System SDR/SSR

LPS Data Transfer Subsystem (LDTS)

File Name : lps_7
Title : Untitled
Creator : Teamwork-PostScript Access Interface
CreationDate : Wed Mar 1 11:52:02 1995
Pages : 0

Generate DAN, Receive DTA, Send DAN, Transfer Files

- Provide ability to coordinate transfer of LPS output files to the LP DAAC
- Provide ability to notify LP DAAC of the availability of LPS files
- Provide ability to report file transfer problems with the LP DAAC
- Provide ability to receive notification from LP DAAC of successful transfer of LPS files

Delete LPS Files

- Provide ability to store LPS data files until confirmation of successful transfer is received from the LP DAAC
- Provide ability to delete all files on a contact period basis

Retain LPS Files

- Provide capability to retain files on a contact period basis

Generate Transfer Summary

- Generate LPS file transfer summary on a daily basis

Control Send DAN

- Provide capability to enable or disable automatic file transfer

Input

- MACS
  - » Setup information
  - » Directives
  - » Transfer file list per subinterval
  - » Metadata files per subinterval
- MFPS
  - » Mirror scan correction data (MSCD) file
  - » Calibration file
- IDPS
  - » Band files
  - » Browse files
- PCD major frame file from PCDS
- Data transfer acknowledgment (DTA) from LP DAAC

Output

- MACS
  - » Summary report of file transfers
  - » Status/error messages
- LP DAAC
  - » Data availability notice (DAN)
  - » Level 0R files

Landsat 7 Processing System SDR/SSR

LDTS Performance Requirements

- Each LPS string must have the capability to transfer the string's daily volume of LPS output files to the LP DAAC at an average aggregate rate of 10 Mbps.
- Generate Data Availability Notices (DANs) from required inputs at a peak rate of not less than 92 bits per second.
- Provide the capability to execute concurrently with all other LPS subsystems.
- Begin to generate a Data Availability Notice (DAN) immediately upon receipt of required inputs.
- Output a DAN within 250 seconds of the time of receiving all required inputs.

LP DAAC Interface

- PACOR II/DDF DAN interface software
- File transfer handled by FTP system software

Methodology

- Requirement Collection & Analysis
- Conceptual Design
- Logical Design
- Physical Design
- Implementation

MACS

- Store LPS configuration parameters
- Store contact schedules
- Store metadata accounting information

RDCS

- Provide LPS configuration parameters
- Store contact summary information

RDPS

- Provide CCSDS processing parameters and thresholds
- Store RDPS quality and accounting information on a contact basis

MFPS

- Provides and stores sensor alignment info, subinterval delta, and thresholds
- Store Level 0R quality and accounting information on a subinterval basis

PCDS

- Provide and store frame fill values, frame quality parameters, error report thresholds, and scene calculation parameters
- Store WRS parameters
- Store PCD quality and accounting information

IDPS

- Provide and store band parameters for ACCA
- Store IDPS quality and accounting information

LDTS

- Provide LPS file information for data transfer and file transfer summaries
- Provide LPS file information for data transfer and file transfer summaries
- Update status of all LPS files

Database Access time must be optimized

- Distribution of database tables across disk drives
- Provide indexing for fast information retrieval
- Support virtual tables for restricted views
- De-normalize to reduce need to query across tables
- Optimize queries
- Provide stored procedures

Reliability

- On-line backups and recovery
- On-line archiving
- Mirroring of critical database files

Data Integrity

- Provide support for entity integrity
- Provide support for domain integrity
- Provide support for referential integrity

Security

- Provide support for selective granting of privileges
- Provide support for user id and password protection

Landsat 7 Processing System SDR/SSR

- **Approach**
- **Software Requirements Specification**
- **Software Sizing Estimates**

Landsat 7 Processing System SDR/SSR

Software Sizing Estimates

Subsystem

RDCS	- 3,000
RDPS	- 6,000
MFPS	- 12,000
PCDS	- 7,000
IDPS	- 7,000
MACS	- 10,500
LDTS	- 3,000
Total DSI	**- 48,500**

Analysis Tools

1,500 DSI

Total

50,000 DSI

Landsat 7 Processing System SDR/SSR

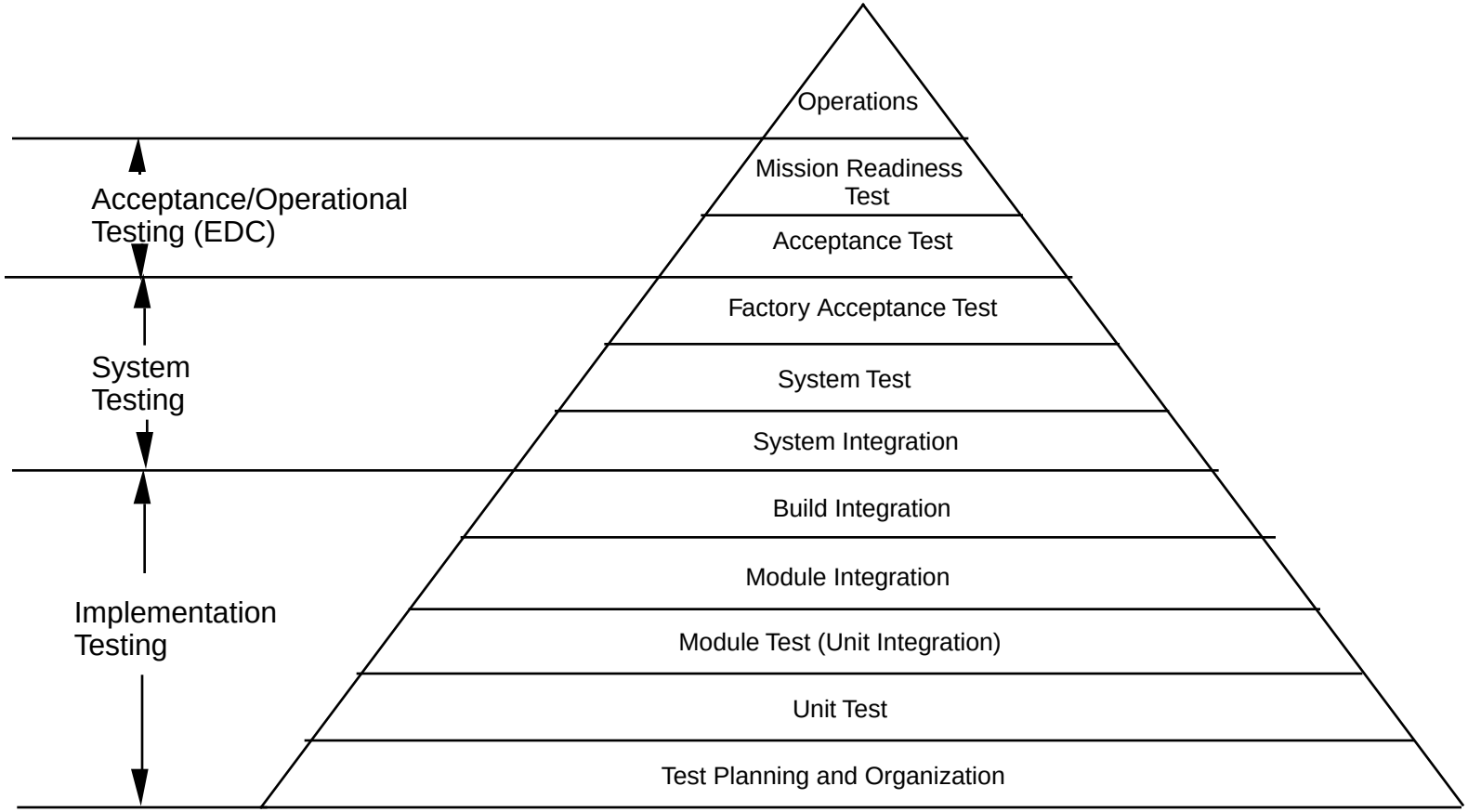
Agenda

- Introduction
- System Design
- Software Specification
- Conclusion

  Testing Approach
  Release Plan
  Issues/Risks
  Schedule

Landsat 7 Processing System SDR/SSR

Testing Approach



Landsat 7 Processing System SDR/SSR

Testing Approach

- **Test Plans and Test Data Requirements developed during Preliminary Design Phases**
- **Factory Acceptance Test to be planned by EDC personnel and executed at GSFC**
- **Acceptance Testing to be performed by EDC**
- **Engineering Versions of Dump and Analysis tools to be provided to EDC**

Landsat 7 Processing System SDR/SSR

Release Plan

- **Release 1**
  - **Build 1**
    - » **Functionalities to support CCSDS and BCH supporting the instrument I&T**
  - **Build 2**
    - » **Support External Interface Testing**
- **Release 2**
  - **Build 3**
    - » **Requirements fully met**

Landsat 7 Processing System SDR/SSR

Open Issues

- Raw capture to RAID disks prototyping is continuing
- Extent of Parallel processing/real time extension usage in software development still needs to be determined
- LGS Interface
  - Schedule driven vs. data driven for LGS interface
- LP DAAC Interface
  - Aggregation of I and Q channel data
  - Output file granularity and formats (HDF)
  - Communication Interface with DAAC not clearly defined, requires further analysis
- IAS Interface
  - Simple electronic interface is desirable given the number of parameters now being ingested

Landsat 7 Processing System SDR/SSR

Risk Analysis

- **DMR not currently baselined:**
  - **design of ETM+ instrument well defined**
  - **baselined version of Data Format Control Book**
  - **image data formats based on Landsat 4 & 5**
- **Requirements Creep**
  - **Costing Profile does not have room for additional requirements**
  - **Careful Control of Requirements and line of code estimates**

Landsat 7 Processing System SDR/SSR

Schedule

Landsat 7 Processing System SDR/SSR

RIDS

- **Please submit RIDS to: Phil Province (bldg 23, RM C429, 286-7731) no later than March 23, 1995**

Landsat 7 Processing System SDR/SSR

Acronyms

ACCA	Automatic Cloud Cover Assessment
ADP	Attitude Data Points
Ao	Operational Availability
ANSI	American National Standards Institute
AOS	Advanced Orbiting Systems
API	Applications Programming Interface
BCH	Bose-Chaudhuri-Hocquenghem EDAC
BER	Bit Error Rate
CADU	Channel Access Data Unit
CASE	Computer Aided Software Engineering
CCA	Cloud Cover Assessment
CCB	Configuration Control Board
CIS	Centralized Information System
COTS	Commercial Off-the-Shelf
CPU	Central Processing Unit
CCSDS	Consultative Committee on Space Data System
CLCW	Command Link Control Word
CRC	Cyclic Redundancy Check
CRUD	Create, Retrieve, Update, Delete
CVCDU	Coded VCDU
DAMT	Distributed Application Monitor Tool
DAN	Data Availability Notice
DBMS	Database Management System
DD	Data Dictionary
DDE	Data Dictionary Entry
DDF	Data Distribution Facility
DDL	Data Definition Language
DFCB	Landsat & System, Data Format Control Book
DFD	Data Flow Diagram
DPCP	Distributed Process Control Program
DSI	Delivered Source Instruction
DSN	Deep Space Network
DSP	Digital Signal Processing
DTA	Data Transfer Acknowledgment
ECS	EOSDIS Core System
EDC	EROS Data Center
EDAC	Error Detection and Correction
EDP	Ephemeris Data Points
EOL	End of Line
EOSDIS	Earth Observation Data Information System
ER	Entity Relationship
ERD	Entity Relationship Diagram
EROS	Earth Resources Observation System
ESMO	Earth Science Mission Operations
ETM+	Enhanced Thematic Mapper Plus (instrument)
EPA	Euler Parameters
FDDI	Fiber Distributed Data Interface
FHS ERR	First Half Scan Error
FTAM	File Transfer Access and Management
FTP	File Transfer Protocol
F&PR	Functional and Performance Requirements
F&PS	Functional and Performance Requirements
GByte	Gigabyte
GCI	Geocentric Inertial
GHA	Greenwich Hour Angle
GOTS	Government Off-the-Shelf

Landsat 7 Processing System SDR/SSR

Acronyms (con't)

GSFC	Goddard Space Flight Center
GTSIM	Generic Telemetry Simulator
GUI	Graphical User Interface
HDF	Hierarchical Data Format
HDS	Horizontal Display Shift
HWC	Hardware Component
HWCI	Hardware Configuration Item
IAS	Image Assessment System
ICD	Interface Control Document
ID	Identification
IDD	Interface Data Description
IDPS	Image Data Processing Subsystem
IM	Information Modeling
IMU	Inertial Measurement Unit
IPD	Information Processing Division
ISO	International Organization for Standardization
Kbps	Kilobits per second
LAN	Local Area Network
LCC	Life-cycle Cost
LDTS	LPS Data Transfer Subsystem
LGS	Landsat 7 Ground Station
LPS	Landsat 7 Data Processing System
LP DAAC	Land Processes Distributed Active Archive Center
LRU	Line Replaceable Unit
LZP	Level Zero Processing
MACS	Management and Control Subsystem
Mbps	Megabits per second
MFPS	Major Frame Processing Subsystem
MSCD	Mirror Scan Correction Data
MDT	Mean Downtime
MJF	Major Frame
MOC	Mission Operations Center
MO&DSD	Mission Operations and Data Systems Directorate
MTBF	Mean time between failures
MTTR	Mean time to repair
MTTRes	Mean time to restore
NASA	National Aeronautics and Space Administration
NCC	Network Communication Center
NHB	NASA Handbook
NCSA	National Center for Supercomputing Applications
NMAS	Martin Marietta Astro Space
NMOS	Network Mission Operations Support
NOAA	National Oceanic and Atmospheric Administration
PCD	Payload Correction Data
PCDS	PCD Data Processing Subsystem
PN	Pseudo-Random Noise
QA	Quality Assurance
RAID	Redundant Array of Inexpensive Devices
RAM	Random Access Memory
RDCS	Raw Data Capture Subsystem
RDPS	Raw Data Processing Subsystem
RMA	Reliability, Maintainability, and Availability
RMS	Root, Mean, Square
R-S	Reed-Solomon (error detection and correction scheme)
RT	Real Time
SCCS	Source Code Control System

Landsat 7 Processing System SDR/SSR

Acronyms (con't)

SCLF	Search, Check, Lock, Flywheel
SCN DIR	Scan Direction
SD	System Design
SDL	Storage Definition Language
SDS	System Design Specification
SGI	Silicon Graphics, Incorporated
SHS ERR	Second Half Scan Error
SLDPF	Spacelab Data Processing Facility
SMP	Systems Management Policy
SN	Space Network
SQL	Structured Query Language
SRR	Software Requirements Review
SSDM	Structured Systems Design Methodology
STDN	Spaceflight Tracking and Data Network
SV	Space Vehicle
SVR4	System V Release 4
SWCI	Software Configuration Item
TBD	To Be Defined/Determined
TBR	To Be Resolved
TDM	Telemetry Decommutation
UIL	User Interface Language
USGS	United States Geological Survey
UTC	Universal Time Coordinated
VCDU	Virtual Channel Data Unit
VCDU-ID	VCDU Identifier
VCID	Virtual Channel ID
VER	Version Number
VME	Versa Module European
WRS	World Reference System
WWV	Time Signal Radio Station with National Bureau of Standards information